THE U.S. NAVAL OBSERVATORY

STAR

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The Captain's Corner

CAPT David Gillard, Superintendent

MY COMMAND PHILOSOPHY for the U.S. NAVAL OBSERVATORY

The U.S. Naval Observatory is the world's best at our mission: determine precise time and observe astrometric data for applications to navigation, targeting and precise positioning and provide that information in the form of operational support to the Department of Defense. As the world's best, we always look forward, charting our course to provide even better support to maintain our forces' warfighting advantages and to help ensure safety of navigation and situational awareness. All our efforts will be measured by whether they contribute to furthering the capabilities of our DoD customers. As we pursue these challenges, we will be guided by the following principles:

KEEP PEOPLE FIRST. While consistent achievement of our mission is priority one, valuing our people is of paramount importance. Each person has a unique gift to contribute to our mission. We recognize their worth and maximize their benefit to the mission and to ourselves by treating each other with respect and dignity. Both as individuals and as a command, our actions and words set standards by which our integrity will be measured, and we strive to keep those standards above reproach. Each of us, from commanding officer to newest employee, is entrusted with a certain level of authority and responsibility, and we are all held accountable for our actions. Leaders lead, and an important part of leadership is the development of future leaders. Sincere interest and action in the development of subordinates, both in technical acumen and in leadership and management skills, is critical. Each person in this command is valuable, and together we are absolutely critical to the security of our nation.

EXPECT EXCELLENCE. We have all been given and have developed special talents. Our country and our fighting forces demand that we use those talents to constantly pursue excellence, whether developing the world's best clock or editing an almanac, fabricating complex astrometric instruments or processing a travel claim. We look to improve at all times and in all disciplines. In this regard, taking risks is encouraged when the risk/benefit ratio is likely to lead to better performance. Failure in the pursuit of excellence is better than success in the status quo; excellence requires risk-taking.

LOOK AHEAD TO STAY RELEVANT. Warriors and warfighting systems today require extremely precise timing and astrometric data to carry out precision engagements, detect and track targets, and interoperate with other forces. This requirement will grow even faster in the future, and new requirements will arise which will stress the abilities of the USNO. Flexibility and agility, in both organizational alignment and technical ability, enables us to be able to meet these challenges. We will not be wed to old ways or old missions when those become less relevant to our customers, but will always look forward to develop new needed capabilities. While maintaining the important interactions we have with civilian and international partners, we seek to make everything we do relevant to the needs of the DoD. The Navy and DoD have growing needs for improved integrated navigational capabilities, and the USNO will support the technological aspects by tailoring our precise time and astrometry capabilities for those capability needs.

People come first. Expect excellence. Stay relevant.

In This Issue:

AN EXTERNAL TEST OF UCAC

Norbert Zacharias, Astrometry Department

The goal of the USNO CCD Astrograph Catalog (UCAC) project is to provide highly accurate star positions. Though the project is still underway (expected to complete full sky coverage sometime in 2004), over the last two years we have provided many researchers with updated positions beyond the published UCAC1 catalog.

Many users see these positions as almost "error free" reference stars compared to their observational errors. Only some users can provide a critical external confirmation of the UCAC quality. One such test happened recently.

UCAC data enables efficient observation of occultation events. If a small solar system body, such as an asteroid or Pluto, passes in front of a star the light of that star is temporarily blocked and a sudden drop in brightness is registered. From the time and duration of these events as observed from slightly different locations on Earth, the exact size and shape of the solar system object can be determined. However, the highest accuracy of star positions is required for these predictions, otherwise people will travel long distances and literally be out in the field with their equipment but see nothing happen.

Answering a request by M. Person of MIT, in February 2002 we provided UCAC positions of about 2000 background stars along the path of Pluto for this summer's occultation observing campaigns.

On September 12th, M. Person wrote the following (extract):

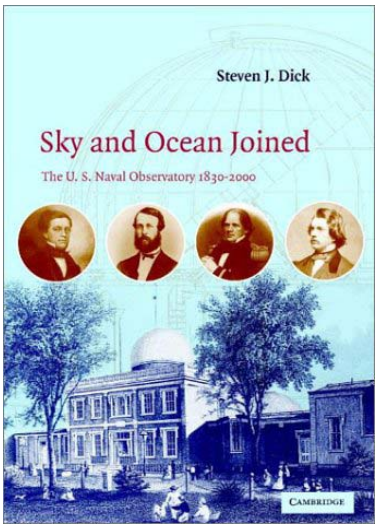
"I wanted to thank you for your providing us with excerpts from the UCAC catalog under production for use in our Pluto occultation predictions and observations this summer. The observations went well, especially for the second event, and post event astrometry indicates that the use of the UCAC catalog positions you supplied improved our predictions markedly.
The second prediction in particular showed a post-event error of less than 10 mas! We eagerly await the publication of UCAC2 and wish you luck with your production efforts."

Gary Weider balances the UCAC 8-inch Astrograph at NOFS, October, 2001

TWO NEW BOOKS BY USNO STAFF MEMBERS

Just in time for summer reading, two books written by USNO staff members are on bookstore shelves and online book vendors. *Sky and Ocean Joined, The U.S. Naval Observatory 1830 – 2000* is the definitive history of USNO, written by historian Steven J. Dick, published by Cambridge University Press.

Latitude: How American Astronomers Solved the Mystery of Variation is co-authored by EO's Merri Sue Carter and her father, Dr. Bill Carter. Published by the Naval Institute Press, this book describes the life and work of Seth Carlo Chandler, the amateur scientist who, through his own ingenuity and determination, discovered the periodic variation of the Earth's rotational pole that now bears his name as the "Chandler Wobble".



The cover of Steve Dick's new book on the USNO's history

Steve Dick and Merri Sue Carter proudly display the fruits of their labors.

USNOFS IDENTIFIES THE COLDEST STAR

Astronomers from the U.S. Naval Observatory (USNO) and UCLA have discovered the coldest and faintest known star, a "brown dwarf" located 19 light-years from the Sun in the constellation Eridanus.

The findings were presented at the American Astronomical Society's 201st meeting in Seattle, Washington by Dr. Frederick Vrba, who heads a team of astronomers investigating faint stars at USNO's Flagstaff Station, Flagstaff, AZ. This discovery has important implications for the relationship between stars and planets.

The Naval Observatory astronomers were able to deduce the cold temperature of this brown dwarf, known as 2MASS J04151954-0935066, or 2MASS 0415-0935 for short, by determining its distance from the Sun. Using a technique called parallax measurement, they traced its apparent tiny elliptical path against a background of much more distant stars caused by the Earth's annual revolution around the Sun. "By observing this motion over several years," explained Vrba, "it is possible to triangulate a precise distance to the nearby star." USNO has long been a leader in this research area, determining the distances of about a thousand nearby stars using visible light parallaxes.

However, brown dwarfs such as 2MASS 0415-0935 are so cold that they emit almost no visible light. Virtually all of their energy emission is in the infrared portion of the electromagnetic spectrum, the same kind of "invisible" light that beams out of television and stereo remote control units. Vrba and his research group used the 1.55-meter (61-inch) Strand Astrometric Telescope at the Flagstaff Station along with a new generation of infrared array detectors to pioneer the technique of parallax determination at these wavelengths.

By using the parallax distance, the apparent brightness of the brown dwarf, and some physics to estimate its size (roughly the same as the planet Jupiter), the astronomers calculated the surface temperature of this object to be a mere 410ºC (770ºF), not much warmer than a household oven.

While this may not seem chilly to those of us emerging from the grip of a long winter, for a star, 2MASS 0415-0935 is downright frigid. The Sun's surface is a comparatively searing 5500ºC (9940ºF). Brown dwarfs can be colder than traditional stars because their low masses, typically less than 8% that of the Sun, inhibit the Hydrogen fusion reactions that

power most stars. Without these energy-generating reactions, brown dwarfs radiate away their heat and eventually cool to temperatures much lower than that of any star.

"Because this object is so cold, it emits very little light," explained UCLA postdoctoral fellow Dr. Adam Burgasser, who originally discovered the brown dwarf in 2001 using the Two Micron All Sky Survey (2MASS). "It would take a half a million of these brown dwarfs to produce the same amount of light as the Sun." Indeed, the USNO measurements confirm that 2MASS 0415-0935 is both the coldest and faintest star ever found. "While it will take another two years of observations to make a final distance determination, its current place as the dimmest star seems fairly certain." said Vrba.

Very cool brown dwarfs like 2MASS 0415-0935 are starting to challenge conventional views of what stars and planets are. Astronomers have detected both methane and water vapor in this object, gases that are present in the atmospheres of planets like Jupiter and even the Earth, but not in any normal stars. Furthermore, most brown dwarfs have sizes and masses similar to those of giant planets found orbiting other stars. "Physically, this object looks very much like a planet," commented Burgasser. "But it doesn't orbit around a star like planets do, and it probably formed like a star in the first place. How do you make the distinction?"

Vrba and his team hope to shed at least some light on that question. This discovery was part of a much larger study to determine the distances of very cool stars recently identified in various sky surveys such as 2MASS.

"2MASS 0415-0935 has certainly helped narrow the gap between stars and planets, but it may not hold its title as the faintest brown dwarf for long," said Vrba. "As we continue to observe these faint 'stars' we will get a better census of what the true population is of dim, cool objects near the Sun. We may yet find dimmer and cooler objects."

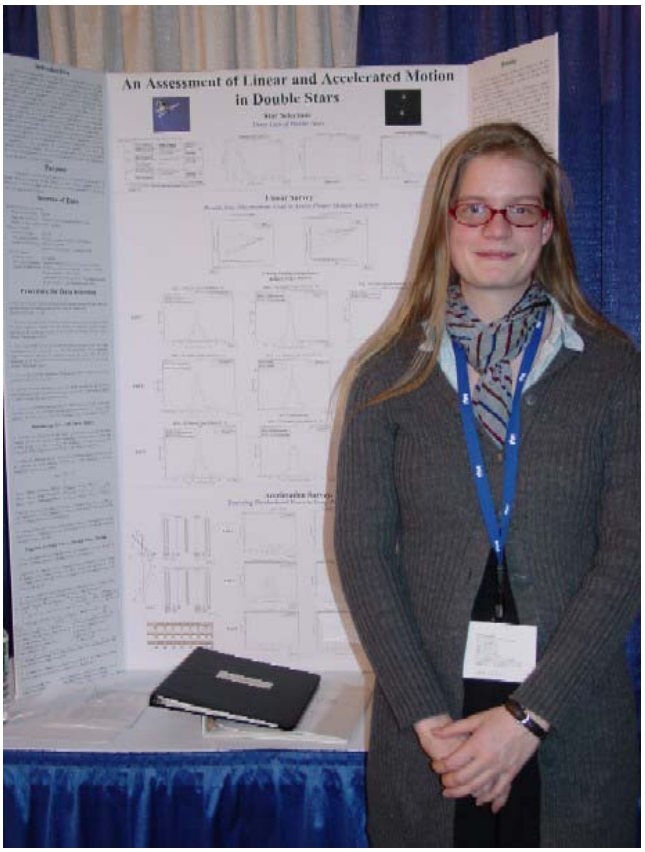
The 2MASS project is headed by the University of Massachusetts in Amherst, MA, and the Infrared Processing and Analysis Center in Pasadena, CA, as a part of NASA's Origins Program. 2MASS is funded by NASA's Office of Space Science, and by the National Science Foundation. Additional 2MASS information and images are available at http://www.ipac.caltech.edu/2mass, and at http://pegasus.phast.umass.edu.

2MASS J04151954-0935066 is the reddish object at the center of this RGB image obtained with the 1.55-meter Kaj Strand telescope at NOFS.

USNO SEAP student gains Intel Science Talent Search Finals

George Kaplan, Astronomical Applications Department

The finals of the 2003 Intel Science Talent Search were held here in Washington during the week of March 6 – 11, 2003. The STS finals recognize the top 40 high school students in the country in science and math. One of USNO's SEAP interns, Sabrina Snell, was one of the 40 finalists, based on her project "An Assessment of Linear and Accelerated Motion in Double Stars", work done here at USNO over the past several summers in the AA and AD departments.



Sabrina Snell, 17, USNO SEAP intern, with her project "An Assessment of Linear and Accelerated Motion in Double Stars".

Although Sabrina did not receive one of the top ten awards, her placement as an STS finalist is a significant accomplishment that will open many doors for her in the years ahead. Actually, she was not disappointed with the results; after the past week, she was mostly just exhausted and wanted to get back to her normal (absurdly hectic) life.

The first-place award went to Jamie Rubin of Fort Myers, Fla., for her biochemistry project. The third-place award went to Anatoly Preygel of Montgomery Blair High School for his project on knot theory. (When I was in high school, the only knot theory I knew was how to tie my shoes -- and that was on a good day!) None of the three astronomy projects (which I thought were about even in quality) made it to the top ten, although there was one young lady with a project on the geology of Venus that placed seventh.

All of the 40 finalists received a very special award for their hard work. As announced in the 16 February 2003 batch of Minor Planet Circulars, each student has had an asteroid named in their honor. From now on, asteroid 1999 CK_{47} will be known as (16015) Snell.

A web page with pictures of the project exhibition and the awards gala may be found at http://aa.usno.navy.mil/about/sts2003.html.

Sabrina with Dr. Paul Vance, Superintendent, DC Public Schools, and Dr. Craig Barrett, CEO, Intel Corporation.

OBITUARY:
Christian de Vegt, 1936 – 2002

Dr. Kenneth J. Johnston, Scientific Director
Dr. Norbert Zacharias, Astrometry Department

Our friend, valued colleague and mentor, Professor Dr. Christian de Vegt passed away on July 12, 2002, from his third heart attack, shortly before his 66th birthday.

Christian de Vegt was born 21 August 1936 and raised in Bremen, Germany. He first became a professional instrument maker. Later following his passion for astronomy, he studied mathematics, physics and astronomy in Hamburg, and was a student of Professor Haffner. He received his Ph.D. degree in 1966 with a thesis on the absolute proper

motions of three open clusters, utilizing AC plates as first epoch.

Christian de Vegt conducted his research career at the Bergedorf Observatory in Hamburg, collaborating with Dr. Diekvoss. He became "Wissenschaftlicher Rat" in December 1970 and "Oberrat" in April 1971. After the Bergedorf Observatory joined the University of Hamburg, he accepted a position as professor.

He continued the strong astrometric tradition at Bergedorf by obtaining a new astrograph in 1975. Over 2200 wide-field plates were taken with this instrument between the late 1970's and early 1990's, providing worldwide optical positions of highest accuracy for radio stars and secondary reference stars around extragalactic reference frame sources.
He was the world leader in wide field imaging astrometry (photographic plates as well as CCDs) and developed the block adjustment technique into a practical reality.

Christian de Vegt was a perfectionist who maintained very high astrometric standards. One of his slogans he taught his students was: "poor data are worse than no data", because of the time wasted trying to get good results out of poor data. When sky conditions were moderate he told the student observers: "don't open the dome tonight, there are already enough astronomers out there taking poor data in poor conditions, we don't need to add to this".

From 1991 to 1994 Christian de Vegt served as president of the IAU Commission 24, "photographic astrometry". He published over 100 scientific papers and inspired a generation of astrometrists.

He participated in the Hipparcos Input Catalog project as well as in the Hipparcos system alignment effort. He took great care of all his students, helping them in their careers. He protected the buildings and most instruments at Bergedorf by initiating Historic Landmark status which has now been obtained.

Since the 1970's he collaborated with the U.S. Naval Observatory on reference frame issues. He consulted the USNO Astrometry Department and others in photographic astrometry and measuring machine issues. Up to his last day, Chirstian de Vegt was working on radio star data and promoting a next generation astrograph project. He and Uwe Laux (Tautenburg) completed the design of a 1-meter class astrometric telescope shortly before his death. It is now left to others to build the instrument and to complete the project.

Astrometry has lost one of its leading scientists. Christian de Vegt will be missed by the present generation of astrometrists especially at the U.S. Naval Observatory.

Security Notes

USNO POLICE EMERGENCY NUMBERS:

MEDICAL/FIRE EMERGENCIES: 433-3333
(NDW Regional Operations Center)

34th Street Gate (24/7): 762-1468
South Gate (24/7): 762-1491
Building 59: 762-0339

Naval District Washington (NDW) Force Protection Condition (FPCON) is currently at Bravo +, with FPCON Charlie Measures in effect 33, 35, 36, 38. Force Protection Measures are available for review in NDWINST 5530.14A, Appendix 2.

South Gate hours: 24/7, Sunday - Saturday.

Wisconsin Avenue gate: Closed to vehicular traffic. Pedestrian turnstile (requires swipe card and PIN) is open 24/7

All other gates are closed until further notice.

USNO Vehicle Registration: Building #59, Monday - Friday, 0800 - 1400 hours.

Identification Badges can be obtained at Nebraska Avenue, Building #43. Telephone 764-0507.

Visitor Security Requirements:

All visitors must have photo identification and a sponsor on the USNO staff. Visitors will be issued a visitor's badge at the South Gate upon arrival, which shall be worn at all times and returned to the NDW Police on departure. Visitors should add additional time prior to arriving at their destination for issuance of a visitor's badge and vehicle inspection. ***All non-U.S. citizens are required to be sponsored by two USNO sponsors***. Visitors without sponsorship will not be authorized to enter the U.S. Naval Observatory grounds.

Force Protection Levels, Conditions and Measures: there are five FPCON levels:

NORMAL
ALPHA
BRAVO
CHARLIE
DELTA

NORMAL: Applies when there is no discernible terrorist activity. Under these conditions, only a routine security posture, designed to defeat the routine criminal threat is warranted. Corresponds to Homeland Security Advisory System (HSAS) condition **GREEN** (Low risk).

ALPHA: Applies when there is a general threat of possible terrorist activity against personnel and installations, the nature and extent of which is unpredictable, and circumstances do not justify full implementation of FPCON BRAVO measures. Corresponds to HSAS condition **BLUE** (Guarded Condition).

BRAVO: Applies when an increased or more predictable threat exists. Commanders must be capable of maintaining the measures of this FPCON for several weeks without causing undue hardship to personnel, substantially affecting operational capabilities, or aggravating relations with local authorities and members of the local civilian or host nation community. Corresponds to HSAS condition **YELLOW** (Elevated condition)

CHARLIE: Applies when an incident occurs or intelligence is received indicating imminent terrorist action. Corresponds to HSAS condition **ORANGE** (High condition).

DELTA: Applies when a terrorist attack has occurred, or intelligence indicates likely terrorist action against a specific location. Corresponds to HSAS condition **RED** (Severe condition).

ANNOUNCEMENTS

Public Tour Information

As of March 20, 2003, public tours of the USNO have been suspended. However, we hope that this will be a temporary condition. When the tours resume, they will be offered on alternating Monday evenings from 8:30 pm until 10:00 pm. Tours will include an overview of the Mission and History of the Naval Observatory, a view of the development of USNO's timekeeping responsibilities, and (weather permitting) viewing of celestial objects with the 12-inch Alvan Clark refractor with a staff Astronomer.

Individual tour passes must be reserved in advance for every Monday night tour. You may use the online request form from the USNO website, or send a FAXed request the Public Affairs Office at 202-762-1489 to secure a reservation. Requests for reservations usually need to be submitted four to eight weeks in advance of a scheduled tour. You must provide the names and dates-of-birth of all individuals in your party. As a Requestor, you must also provide a daytime telephone number and/or an e-mail address so that we may contact you with the status of your request.

All visitors (except minors, who must be accompanied by an adult) will be required to present a photo ID that matches their name and date-of-birth information before they are admitted to the grounds. Visitors who do not have a reservation or a valid photo ID will not be admitted under any circumstances.

All visitors must be prepared to submit to a security screening. This may involve passing through a magnetometer and the hand-searching of personal belongings. Security screening will begin at 8:00 pm; please be present at the gate by this time. Refusal to accept these terms will result in denial of admission.

There is considerable walking on hilly ground in darkness during the tour. Please take this into

consideration before you request passes. Once on the grounds visitors will be placed into escorted groups. You must stay with your assigned group throughout the tour. Please be aware that USNO is a military installation, and that tours may be suspended at any time by military security considerations.

Tours may be suspended at any time with little or no prior notice. Please check the Tour information web page at http://www.usno.navy.mil/tour_info.shtml, or the telephone information line at 202-762-1467 for the most current tour status.

…And We Need Volunteers!

With the resumption of public tours, even as limited as they now are, we are still in need of volunteers to show our visitors the time display in the lobby of Building 56 and to operate the telescopes. Staff volunteers are entitled to earn up to 2.5 hours of overtime or compensatory time for each evening worked. Please contact Geoff Chester in the Public Affairs Office if you're interested in helping out.

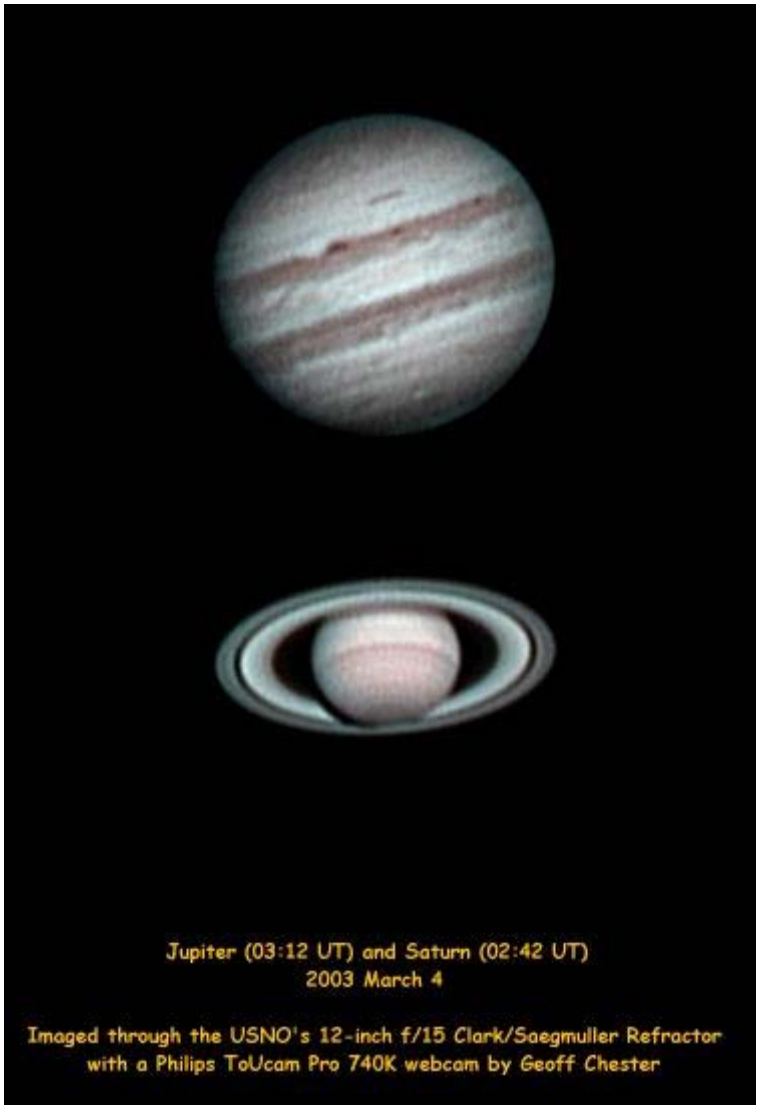
ABSTRACTS OF RECENT PAPERS:

First observations with a co-phased six-station optical long baseline array: application to the triple star Eta Virginis

C. A. Hummel, A. Benson, D. J. Hutter, K. J. Johnston, D. Mozurkewich, J. T. Armstrong, R. B. Hindsley, C. Gilbreath, L*.J. Rickard, N. M. White*

Submitted to The Astronomical Journal*, December 2, 2002*

We report on the first successful simultaneous combination of six independent optical telescopes in an interferometric array. This is double the number of independent telescopes, and five times the number of independent baselines, heretofore combined simultaneously. This was accomplished with the Navy Prototype Optical Interferometer (NPOI) at Lowell Observatory near Flagstaff, Arizona. We describe the main technologies demonstrated including hybrid six-way beam combination, non-redundant multiple optical path modulation for fringe separation, and the fringe detection electronics. To test the array's suitability for high-resolution stellar imaging, we observed the hierarchical triple star Eta Virginis and present the first images resolving all three components. The orbital motions of these stars were followed during winter and spring of 2002. Preliminary, astrometrically determined orbits of the two components in the close pair by reference to the tertiary were derived. This enabled the estimation of the mass ratio (1.27) of the components in the close pair. We also determined the relative orbital inclination to be 31 degrees. Future work needed to improve the calibration of the data is discussed.



USNO
H*A*P*P*E*N*I*N*G*S
Awards!

2002 marked the bicentennial of the publication of Nathaniel Bowditch's ***American Practical Navigator***. USNO personnel were instrumental in the success of the bicentennial celebrations in Bowditch's home town of Salem, MA.

Front row, left to right: Sethanne Howard, Brenda Corbin, Bob Miller, John Bangert, Nancy Oliverson, and Greg Shelton were presented with copies of the latest edition of "Bowditch", and certificates recognizing their contributions to the success of the event.

Superintendent CAPT Dave Gillard presents certificates of appreciation to this year's CFC Key Workers, Lisa Turner, Nancy Oliverson, IC2(SW) Derrick Nolan, Tom Johnson, and Brenda Hicks.

Once again, USNO exceeded its target total for CFC contributions!

USNO
H*A*P*P*E*N*I*N*G*S
More Awards!

LTJG Ben Johnson (RM) receives his Lieutenant's bars from Superintendent CAPT Dave Gillard at a promotion ceremony held in the Library on March 3, 2003.

The following individuals received Federal Length-of-Service awards:

<u>15 years</u>:
Merri Sue Carter
Ralph Gaume
Dave Hall
Bill Tangren

<u>20 years</u>:
Wanda Ferguson

<u>30 years</u>:
George Luther

<u>40 years</u>:
Mihran Miranian

The U.S. Naval Observatory *Star*
U.S. Naval Observatory, Washington, D.C.

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Deputy Superintendent
Commander Susan Greer

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